

Claims

1. Extrusion apparatus comprising:

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at least one first reservoir (1) connected at a first end to a first opening of a plurality of regulatory modules (4) containing passages (17), through which material (25) is extrudable, wherein the extrusion apparatus (4) has at least 1,000 passage (17) per square metre cross-section.

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2. Extrusion apparatus according to claim 1, wherein the regulatory module (4) additionally comprises at least one second reservoir.

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3. Extrusion apparatus according to claim 2, wherein the second reservoir is fluidly connected to at least an opening in at least one of the passages (17).

4. Extrusion apparatus according to one of the above claims, further comprising sensors (70).

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5. Extrusion apparatus according to one of the above claims, further comprising at least one of the following sensors: pressure sensors, temperature sensors, chemical sensors, pH sensors and/or light-scattering sensors.

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6. Extrusion apparatus according to one of the above claims, wherein at least one of the regulatory modules (4) comprise at least one individual sensor (70).

7. Extrusion apparatus according to one of the above claims, wherein the sensors are integral to the regulatory modules (4).

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8. Extrusion apparatus according to one of the above claims, wherein the regulatory modules (4) further additionally comprise one or more pumps (2).

9. Extrusion apparatus according to one of the above claims, wherein the regulatory modules (4) further additionally comprise piezo-electric or vibration pumps (2).

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10. Extrusion apparatus according to one of the above claims, wherein the tubular passages (17) have flow inlets.

10 11. Extrusion apparatus according to one of the above claims, wherein the interior wall of the passages (17) are made of a permeable material.

12. Extrusion apparatus according to one of the above claims, wherein the regulatory modules (4) are injection moulded.

15 13. Extrusion apparatus according to one of the above claims, wherein the regulatory modules (4) are formed by ablation.

20 14. Extrusion apparatus according to any of the above claims, wherein in operation the material (25) is drawn down at a first distance at least 0.5 mm from an outer exit opening (13) within the passage (17).

25 15. Extrusion apparatus according to any one of the above claims, wherein a component of the material (25) in an initial zone in one of the passages (17) forms rod-shape units (64) that are substantially perpendicular to the internal surface of the passage (17).

30 16. Extrusion apparatus according to any one of the above claims, wherein a component of the material (25) in a subsequent zone (62) of one of the passages (17) has rod-shaped units (64) which tumble as material (25) flows within the passage (17).

35 17. Extrusion apparatus according to any one of the above claims, further comprising a ridged surface (66) having a plurality of ridges (60) on the internal surface of the passage (17).

18. Extrusion apparatus according to claim 17, wherein the height of the ridges (60) are less than 10% than the diameter of the passage (17).

- 5 19. Extrusion apparatus according to one of claims 17 or claim 18, wherein the ridged surface (66) has a surface energy lower than the surface energy of the material (25).
- 10 20. Extrusion apparatus according to one of the claims 17 to 19, wherein the ridges (60) are substantially oriented along a long axis of the tubular passage (17).
- 15 21. Extrusion apparatus according to one of the claims 17 to 20, wherein the ridges (60) are made of hydrophobic material.
- 20 22. Extrusion apparatus according to one of the claims 17 to 20, wherein the ridges (60) are coated with hydrophobic material.
- 25 23. Extrusion apparatus according to one of the claims 17 to 22, wherein the draw down occurs substantially adjacent to the ridge-shaped surface coating (66).
- 30 24. Extrusion apparatus according to any one of the above claims, wherein the material (25) is a liquid crystalline polymer.
- 25 25. Extrusion apparatus according to any one of the above claims, further comprising cleaning apparatus.
- 30 26. Extrusion apparatus according to claim 25, wherein the cleaning apparatus comprised a permeable interior wall of the passage (17) through which cleaning agents are introduced.
27. Extrusion apparatus according to claim 26, wherein the cleaning agents are alkaline fluids.
- 35 28. Extrusion apparatus according to one of claims 3 to 27, further comprising a microprocessor (75) connected to the sensor (70).

5 29. Extrusion apparatus according to claim 28, wherein the microprocessor (75) has an output for sending signals to regulate at least one parameter of the extrusion apparatus.

10 30. Extrusion apparatus according to one of claims 28 or 29, wherein the microprocessor (75) is integral to the regulatory module (4).

15 31. Extrusion apparatus according to any one of the above claims, wherein the extrusion apparatus is a spinning apparatus.

15 32. Object formed from the extrusion apparatus according to any one of the above claims.

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